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Formal aspects of a generic model of trust for electronic commerce

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Abstract

In this paper, we describe how an agent's trust in transactions is a combination of an agent's trust in the other party and the trust in the control mechanisms for the successful performance of the transaction. This distinction is, in particular, relevant for international business-to-business electronic commerce, where trading partners often do not know each other before the trading takes place. We argue also that the agent's understanding of a control mechanism is essential for the agent's trust in that control mechanism. We give a formal analysis of the understanding that is required for control mechanisms to work and for determining the subjective level of trust in control mechanisms in electronic commerce. © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Electronic commerce; Formal analysis; Trust

1. Introduction

1.1. Trust in electronic commerce

With the advent of Electronic Commerce, many people have become interested in trust issues. Most people agree that electronic commerce can only become a success if the general public trusts the virtual environment. Trust in electronic commerce is, therefore, an important issue to investigate (for an overview, see Ref. [20]). In this paper, we focus on transaction trust, i.e. the trust that is needed to engage in a transaction. We investigate the determinants of trust in electronic commerce and we present different methods to increase the level of trust in a transaction.

The basic assumption of our generic trust model is that an individual only engages in a transaction if his level of trust exceeds his personal threshold. This personal threshold depends on the type of transaction and the other parties involved in the transaction. For example, the threshold will be high if the value of the transaction is high and the threshold will be low if the agent shares a long history of satisfactory trade transactions with his trading partner. Fig. 1 gives a graphical representation of the generic trust model. In the center of this figure is the trustor's transaction trust; i.e. the mental state of the trustor that determines whether he has sufficient trust to engage in a transaction. The determinants of the trustor's trust threshold are represented in the lower half of Fig. 1. Several determinants for a person's threshold can be distinguished. The potential profit for the person, the risk involved, the person's attitude towards risk or risk propensity, i.e. risk seeking, risk neutral, risk averse are examples of such determinants. The upper half of

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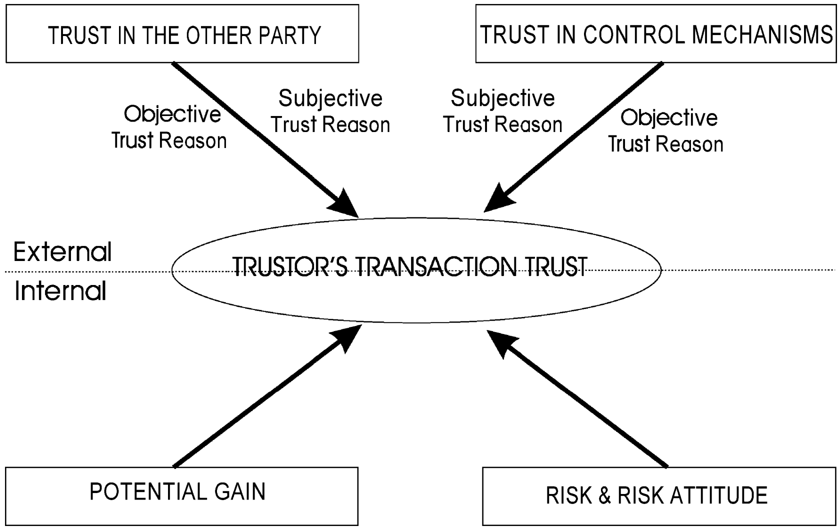

Fig. 1. The generic trust model.

Fig. 1 represents the trust determinants such as the trust that the counter party in a transaction induces in the trustor and the trust that control mechanisms induce in the trustor. By a control mechanism, we mean procedures and protocols that monitor and control the successful performance of a transaction. There are basically two ways to enable a specific electronic trade transaction: either by decreasing the personal threshold of the potential actor with respect to this transaction or to increase his trust level related to this transaction. Here, we focus on methods to increase trust levels.

In this paper, we present a formal analysis of several aspects of the control procedures and protocols that can be used to increase trust. In particular, we analyse the so-called evidence rules and the understanding the agents have about these rules. Evidence rules are rules that state that a certain document reliably indicates that a certain world fact has happened. For example, the receipt you receive in a supermarket reliably indicates the existence of a contract of sale between you and the supermarket. The receipt is not the contract of sale itself. It only evidences that such a (perhaps implicit) contract of sale exists. Because the source (issuer) of the document is important for the evidence relations, we also show how to model the reliability of information sources.

1.2. Why is electronic commerce not trusted?

Why is it that people would not trust electronic commerce in the first place? It has been argued that trust is needed only in risky situations [15] and to trust essentially means to take risks and leave oneself vulnerable to the actions of trusted others [13]. The electronic commerce environment is obviously an environment with risk. Many types of risks can be explained by looking at the information available to the parties in a transaction. We can distinguish three typical situations: (i) the situation of perfect information in which all parties know everything that is relevant for a transaction, (ii) the situation of equal ignorance where all the parties have an equal lack of information relevant for a transaction, and (iii) the intermediary situation of information asymmetry in which one party has information that the other party does not have. This situation of information asymmetry is the most interesting one, because it may give rise to opportunistic behavior. Williamson [24,25] describes opportunism as ‘self interest seeking with guile’ and as making ‘self disbelieved statements.’ In other words, opportunism is trying to exploit the information asymmetry to your own advantage. The textbook example of opportunism is the situation of a used-car market. The seller knows the quality of the car, while the buyer does not. The seller can try to